



Productive qualities of young pigs of the Large White breed of diverse genealogical lines and interbreed differentiation according to some integrated indicators

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The purpose of the work was to investigate the fattening and meat qualities in young pigs of the Large White breed of diverse genealogical lines and interbreed differentiation according to some integrated indicators and to calculate the economic efficiency of the experimental results. The fattening and meat qualities in young pigs were evaluated by the quantitative characteristics such as average daily live weight gain during the control fattening period (g), the age of reaching 100 kg live weight (days), thickness of lard at the level of 6–7 thoracic vertebrae (mm), length of the chilled carcass (cm), length of the bacon half of the chilled half-carcass (cm). Comprehensive evaluation of the animals in the experimental groups was carried out according to the Tyler and Wangen indices. Biometric processing of research results was conducted according to the methods of V. P. Kovalenko et al. (2010). The research was performed in agricultural formations of the Dnipropetrovsk region, the *Jazz* meat processing plant, and the animal husbandry laboratory of the Institute of Grain Crops NAAS of Ukraine. It was established that in terms of fattening and meat qualities, the young pigs of the genealogical lines Tafftus C61203 UA 8819345 and Azuro UA 8800557 of the Large White breed correspond to the elite class. Young pigs of the genealogical line Tafftus C61203 UA 8819345 outperform peers of the Azuro line UA 8800557 by 3.25% in the age of reaching a live weight of 100 kg, in fat thickness at the level of 6–7 thoracic vertebrae by 5.74%, in chilled carcass length by 0.93%. Animals of the Azuro UA 8800557 line are characterized by a longer length of the chilled carcass and the length of the bacon half of the chilled carcass. The number of significant correlations between the fattening and meat qualities of the Large White breed young pigs, the CI selection index, and the Tyler index is 80%. The maximum increase in additional production was obtained from young pigs of the genealogical line Tafftus C61203 UA 8819345 (+2.52%), then 1 experimental group according to the Tyler index (+3.98%) and the selection index CI (+4.30%). The criteria for selecting highly productive animals due to the CI breeding index are 57.69–78.57 points, and the Tyler index is 214.89–242.85 points. The economic efficiency of the use of young pigs from the specified groups provides additional production at the level of +3.98–4.30%.

Key words: young pigs, breed, fattening and meat qualities, index, correlation, economic efficiency



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Introduction

Evaluation of young pigs for fattening and meat qualities in agroformations of Ukraine is carried out following the requirements of the current Instructions for growing pigs [8] and “Methods for evaluating boars and sows according to the quality of the offspring in the conditions of breeding farms and breeders” [3]. However, the work experience of specialists and the research of domestic scientists testify to the following:

— the use of foreign-bred animals has a positive effect on improving the fattening and meat qualities of young pigs under the conditions of using different breeding methods [1, 2, 4–6, 15–18, 22];

— according to the requirements of the specified regulatory documents, the animals of the controlled herds correspond to the elite class. How to carry out further selection and breeding work to improve the main quantitative traits, namely age of reaching a live weight of 100 kg (days), fat thickness at the level of 6–7 thoracic vertebrae (mm), length of the chilled carcass (cm).

Therefore, the issue of finding effective methods for the comprehensive evaluation of the productive qualities of pigs taking into account their origin and interbreed differentiation according to some integrated indicators or markers is relevant [23, 24].

Research by domestic scientists indicates that young pigs obtained from a combination of cross-bred sows ($\frac{1}{2}$ Large White breed of Hungarian origin \times $\frac{1}{2}$ Landrace) with boars of the genotype ($\frac{1}{2}$ Duroc \times $\frac{1}{2}$ Piétrain), as well as cross-bred sows ($\frac{1}{2}$ Large White breed of Hungarian origin \times $\frac{1}{2}$ Landrace) with boars of the Duroc breed of Ukrainian selection [10]. They reach a live weight of 100 kg at the age of 178 and 180 days ($P < 0.001$) with average daily gains of 769 and 751 g and feed consumption of 3.42 ($P < 0.001$) and 3.47 ($P < 0.001$) unit for 1 kg of gain. The author reports that the young pigs obtained from the combination of cross-bred sows ($\frac{1}{2}$ Large White breed of Hungarian origin \times $\frac{1}{2}$ Landrace) with boars of the genotype ($\frac{1}{2}$ Duroc \times $\frac{1}{2}$ Piétrain) exceeded the peers of the control group (Large White breed of Hungarian origin) in terms of half-carcass length by 6 cm, the thickness of the bacon by 1.33 mm, the area of the “muscle eye” by 8.81 cm². This group also had a high slaughter yield 75.66%, while the control group had 73.07%. A greater weight of the rear third of the half-carcass and meat yield characterized animals of the specified genotypes.

Comprehensive studies conducted by O. O. Krasno-shchok testify that the best fattening qualities are characterized by the young pigs of the combination of Great White and Landrace, which proves the effectiveness for the first hybridization stage; the effect of heterosis is 111.58% [13]. The author notes that the influence of combinations on average daily growth is 24.56% ($P \leq 0.05$), and the intensity of formation is 26.67 ($P \leq 0.05$); according to precocity, respectively, 26.85 and 16.97% ($P \leq 0.05$), according to feed consumption — 25.10 and 23.74% ($P \leq 0.05$). It was established that the use of Landrace breeders and terminal boars improved the meat quality of crossbred and hybrid pigs: the slaughter yield increased by 2.6% ($P \leq 0.001$); 1.6% ($P \leq 0.05$); 3.2%

($P \leq 0.001$), the area of the “muscle eye” — by 10.2 cm² ($P \leq 0.001$); 7.2 cm² ($P \leq 0.001$); 13.9 cm² ($P \leq 0.001$), the mass of the bone — by 0.8 kg ($P \leq 0.01$); 0.7 kg ($P \leq 0.05$); 0.7 kg ($P \leq 0.01$), fat thickness decreased by 6.8 mm ($P \leq 0.001$); 7.5 mm ($P \leq 0.01$); 7.8 mm ($P \leq 0.001$). The correlation between the genotypes of the LEP 2845 gene with high average daily gain, a younger age of reaching 100 kg live weight, and lower feed consumption during fattening was revealed.

The works of scientists [21, 20, 14, 19, 7] testify to the effectiveness of using pigs of foreign origin and methods of index selection. **The work aims** to investigate the fattening and meat qualities of young pigs of the Large White breed of different genealogical lines and interbreed differentiation according to some integrated indicators, as well as to calculate the economic efficiency of the experimental results.

Materials and Methods

The experimental part of the work was carried out at the “Druzhba-Kaznacheivka” dairy farm of the Dnipropetrovsk region, the “Jazz” meat processing plant, and the animal husbandry laboratory of the Institute of Grain Crops NAAS. The object of research was young pigs of the Large White breed of genealogical lines Tafftus C61203 UA 8819345 and Azuro UA 8800557.

Control fattening of young pigs of the Large White breed was carried out following the requirements of the “Methods for evaluating boars and sows according to the quality of the offspring in the conditions of breeding farms and breeding breeders” [3].

Selection indexes of CI (1) and Tyler (2) and the value of additional products (3) were calculated according to the following formulas:

$$CI = 0.18 \times X_1 - 4.46 \times X_2 \quad (1),$$

where CI — selection index, points;

X_1 — an average daily gain of live weight during the period of control fattening, g;

X_2 — thickness of fat at the level of 6–7 thoracic vertebrae, mm [19];

$$I_B = 100 + (242 \times K) - (4.13 \times L) \quad (2),$$

where I_B — complex index of fattening and meat qualities;

K — an average daily gain of live weight, kg;

L — fat thickness at 6–7 thoracic vertebrae, mm;

242; 4.13 are constant coefficients [21].

The formation of experimental groups of young pigs was carried out by taking into account their origin and based on the calculation of the average value of CI and Tyler indices. The deviation from the average value of the indices was equal to $\pm (0.67 \times \sigma)$.

The cost of additional products was calculated based on the following data: the purchase price of a product unit, under the current prices, which is valid in Ukraine; average productivity of animals; the average premium of the primary production, which is expressed as a percentage

per 1 animal when applying a new and improved breeding achievement compared to the productivity of animals of primary use; the constant ratio of reduction of the result, which is associated with additional costs for profitable products (0.75); the number of livestock of agricultural animals of a new or improved breeding achievement.

Variational statistics processed the research results according to the methods of V. P. Kovalenko and others [11].

Results and Discussion

It was established that the average daily live weight gain in young pigs of the experimental group (n=45) during the period of control fattening is 781.0±5.78 g (Cv=4.97%), the age of reaching 100 kg live weight is 177.3±0.77 days (Cv=2.93%), lard thickness at the level of 6–7 thoracic vertebrae — 20.7±0.32 mm (Cv=10.36%), chilled carcass length — 96.5±0.31 cm (Cv=1.71%), the length of the bacon half of the cooled carcass is 85.5±0.58 cm (Cv=3.54%). Selection index CI ranges from 19.16 to 78.57, Tyler index — from 126.13 to 182.36 points. The study results of the fattening and meat qualities of young pigs of the Large White breed of different origins and interbreed differentiation according to the Tyler index. The CI selection index is shown in tables 1–3.

It was established that the young pigs of the II group (genealogical line Tafftus C61203 UA 8819345) prevailed over peers I (genealogical line Azuro UA 8800557) in terms of the average daily gain of live weight during the period of control fattening by 25.3 g (td=2.67; P<0,05), the age of reaching a live weight of 100 kg by 5.8 days (td=3.64; P<0.001), the fat thickness at the level of 6–7 thoracic vertebrae by 1.2 mm (td=1.18; P>0,05). The animals were characterized by a longer length of the chilled carcass (by 0.9 cm; td=1.09; P>0.05) and the length of the bacon half of the chilled carcass (by 1.7 cm; td=1.24; P>0.05) lines Azuro UA 8800557 (I experimental group).

The difference between animals of different genealogical lines, according to the Tyler index, is equal to 8.95 points (td=2.28; P<0.05), according to the CI selection index — 8.89 points (td=2.35; P<0.05).

A comprehensive evaluation of young pigs for fattening and meat qualities using the CI selection index and the Tyler index showed that the young pigs of the I group (CI=57.69–78.57 points, Iv=214.89–242.85 points) prevailed age group III (CI=19.16–38.75 points, Iv=178.89–192.72 points) according to the average daily increase in live weight during the period of control fattening by 72.8 (td=8.02; P<0.001) and 70.7 g (td=6.77; P<0.001), the age of reaching a live weight of 100 kg by 8.3 (td=5.28; P<0.001) and 8.9 days (td=5.63; P<0.001), the thickness of lard at the level of 6–7 thoracic vertebrae by 4.2 (td=6.56; P<0.001) and 4.6 mm (td=6.76; P<0.001), the length of the chilled carcass by 1.6 (td=1.86; P>0.05) and 2.0 cm (td=4.16; P>0.001), the length of the bacon half of the cooled carcass by 1.8 (td=1.21; P>0.05) and 2.7 cm (td=2.57; P<0.05).

The results of the calculation of pairwise correlation coefficients between the fattening and meat qualities of young

Table 1. Fattening and meat qualities of young pigs of diverse genealogical lines of the large white breed

Indexes	Biometric indicators	Young pigs of the genealogical line	
		Azuro UA 8800557	Tafftus C61203 UA 8819345
		Group	
		I	II
	n	35	10
1	X±Sx	775.9±6.26	801.2±7.12
	σ±X _σ	37.59±4.496	38.89±8.700
	Cv±Sc _v , %	4.84±0.578	4.85±1.085
2	X±Sx	178.3±0.83	172.5±1.37
	σ±X _σ	5.02±0.600	4.12±0.921
	Cv±Sc _v , %	2.81±0.336	2.38±0.532
3	X±Sx	20.9±0.31	19.7±0.97
	σ±X _σ	1.91±0.228	2.91±0.651
	Cv±Sc _v , %	9.13±1.092	14.58±3.261
	n	23	4
4	X±Sx	96.6±0.34	95.7±0.75
	σ±X _σ	1.67±0.246	1.50±0.531
	Cv±Sc _v , %	1.72±0.253	1.57±0.556
5	X±Sx	85.7±0.64	84.0±1.22
	σ±X _σ	3.08±0.454	2.44±0.865
	Cv±Sc _v , %	3.60±0.530	2.92±1.035
	n	35	10
6	X±Sx	46.14±2.258	55.03±3.038
	σ±X _σ	13.55±1.620	12.11±2.709
	Cv±Sc _v , %	29.36±3.511	22.01±4.923
7	X±Sx	147.67±1.872	156.62±3.452
	σ±X _σ	11.23±1.343	12.59±2.816
	Cv±Sc _v , %	7.60±0.909	8.04±1.798

Note: in this and the following tables, 1 is the average daily increase in live weight during the period of control fattening, g; 2 — age of reaching 100 kg live weight, days; 3 — fat thickness at the level of 6–7 thoracic vertebrae, mm; 4 — length of the cooled carcass, cm; 5 — length of the bacon half of the cooled carcass, cm; 6 — CI, points; 7 — Iv, scored.

Table 2. Feeding and meat qualities of young pigs of the large white breed of diverse interbreed differentiation according to the Tyler index

Indexes	Biometric indicators	Gradations of the Tyler index		
		214.89–242.85	195.52–213.54	178.89–192.72
		Group		
		I	II	III
	n	11	21	13
1	X±Sx	813.4±9.28	788.0±7.19	742.7±4.78
	σ±X _σ	30.78±6.562	32.95±5.084	17.26±3.390
	Cv±Sc _v , %	3.79±0.808	4.18±0.645	2.32±0.499
2	X±Sx	172.5±1.08	177.4±0.94	181.4±1.16
	σ±X _σ	3.58±0.763	4.33±0.668	4.18±0.821
	Cv±Sc _v , %	2.08±0.443	2.45±0.378	2.31±0.453
3	X±Sx	18.3±0.63	20.7±0.23	22.9±0.28
	σ±X _σ	2.11±0.449	1.05±0.162	1.03±0.202
	Cv±Sc _v , %	11.49±2.449	5.10±0.787	4.53±0.889
	n	4	16	7
4	X±Sx	97.7±0.25	96.5±0.46	95.7±0.42
	σ±X _σ	0.50±0.177	1.85±0.327	1.11±0.296
	Cv±Sc _v , %	0.51±0.180	1.92±0.339	1.16±0.310
5	X±Sx	87.0±0.81	85.7±0.89	84.3±0.68
	σ±X _σ	1.63±0.578	3.57±0.631	1.79±0.478
	Cv±Sc _v , %	1.88±0.667	4.17±0.738	2.13±0.569

Table 3. Fattening and meat qualities of young pigs of large white breed of diverse interbreed differentiation according to the selection index CI

Indexes	Biometric indicators	Gradations of the CI selection index		
		57.69–78.57	43.84–56.12	19.16–38.75
		Group		
		I	II	III
	<i>n</i>	12	18	15
1	$X \pm Sx$	816.1±8.00	789.1±7.35	743.3±4.29
	$\sigma \pm X_{\sigma}$	27.72±5.668	31.19±5.198	16.63±3.040
	$Cv \pm Sc_{cv}, \%$	3.40±0.695	3.95±0.658	2.24±0.409
2	$X \pm Sx$	172.6±1.04	177.5±0.97	180.9±1.18
	$\sigma \pm X_{\sigma}$	3.62±0.740	4.15±0.691	4.60±0.840
	$Cv \pm Sc_{cv}, \%$	2.10±0.429	2.34±0.390	2.54±0.464
3	$X \pm Sx$	18.5±0.59	20.7±0.25	22.7±0.28
	$\sigma \pm X_{\sigma}$	2.06±0.421	1.08±0.180	1.09±0.199
	$Cv \pm Sc_{cv}, \%$	11.17±2.284	5.25±0.875	4.84±0.884
4	<i>n</i>	5	14	8
	$X \pm Sx$	97.2±0.80	96.8±0.46	95.6±0.34
	$\sigma \pm X_{\sigma}$	1.78±0.563	1.74±0.328	1.06±0.265
5	$Cv \pm Sc_{cv}, \%$	1.84±0.582	1.80±0.340	1.11±0.277
	$X \pm Sx$	85.8±1.35	86.2±0.91	84.0±0.65
	$\sigma \pm X_{\sigma}$	3.03±0.958	3.40±0.642	1.85±0.462
	$Cv \pm Sc_{cv}, \%$	3.54±1.120	3.95±0.746	2.20±0.550

Table 4. Coefficients of paired correlation between fattening and meat qualities of young pigs of the large white breed, CI selection index, and Tyler index

Sign	Biometric indicators		
	<i>x</i>	<i>y</i>	
CI	1	0.748±0.0656***	11.39
	2	-0.628±0.0903***	6.96
	3	-0.876±0.0347***	25.27
	4	0.283±0.1371*	2.06
	5	0.128±0.1466	0.87
Is	1	0.595±0.0963***	6.18
	2	-0.677±0.0807***	8.39
	3	-0.923±0.0221***	41.83
	4	0.298±0.1358*	2.19
	5	0.155±0.1455	1.07

Note. * — $P < 0.05$; *** — $P < 0.001$.

Table 5. Economical efficiency of using sows of different breeding value

Group	<i>n</i>	Average daily gain of live weight during the control fattening, g	Increase in additional products, %	Cost of additional products, UAH/animal*
General sample	45	781.0±5.78	—	—
<i>intra</i> breed differentiation along the genealogical line				
I	35	775.9±6.26	-0.65	-32.38
II	10	801.2±7.12	+2.52	+121.45
<i>intra</i> breed differentiation according to the Tyler index				
III	13	742.7±4.78	-4.90	-248.34
II	21	788.0±7.19	+0.88	+43.61
I	11	813.4±9.28	+3.98	+191.82
<i>intra</i> breed differentiation according to the SI selection index				
III	15	743.3±4.29	-4.82	-243.62
II	18	789.1±7.35	+1.02	+50.58
I	12	816.1±8.00	+4.30	+207.36

Note. * — the selling price of young pigs at the time of the research was UAH 47.7. for 1 kg of live weight.

pigs of the Large White breed and indices are shown in table 4. Studies have proven that the number of significant correlation coefficients between the fattening and meat qualities of young pigs of the Large White breed of the general sample ($n=45$), the CI breeding index, and the Tyler index is equal to 80%. The significant relationships were established between the following pairs of traits: CI selection index × average daily live weight gain during the control fattening period ($r = +0.748$); CI selection index × age of reaching 100 kg live weight ($r = -0.628$); selection index CI × fat thickness at the level of 6–7 thoracic vertebrae ($r = -0.876$); selection index CI × length of the chilled carcass ($r = +0.283$); Tyler's index × average daily gain of live weight during the control feeding period ($+0.595$); Tyler's index × age of reaching 100 kg live weight ($r = -0.677$); Tyler's index × fat thickness at the level of 6–7 thoracic vertebrae ($r = -0.923$); Tyler index × length of the chilled carcass ($r = +0.293$).

Calculations of the economic efficiency of the research results show that the maximum increase in additional production was obtained from young pigs of the genealogical line Tafftus C61203 UA 8819345 (+2.52%), I experimental group according to the Tyler index (+3.98%) and the CI selection index (+4.30%) (table 5). The cost of additional animal products in the specified groups is +121.45, +191.82, and +207.36 UAH/animal, respectively.

Conclusions

The fattening and meat qualities of young pigs of the genealogical lines Tafftus C61203 UA 8819345 and Azuro UA 8800557 of the Large White breed correspond to the elite class. It was established that the young pigs of the genealogical line Tafftus C61203 UA 8819345 outperform peers of the Azuro line UA 8800557 in terms of the age of reaching a live weight of 100 kg, the thickness of lard at the level of 6–7 thoracic vertebrae and the length of the chilled carcass by an average of 3.3%. Animals of the Azuro line UA 8800557 are characterized by a longer length of the chilled carcass and the length of the bacon half of the chilled carcass.

The criteria for selecting highly productive animals according to the CI breeding index are 57.69–78.57 points, and the Tyler index is 214.89–242.85 points. The number of significant correlations between the fattening and meat qualities of young pigs of the Large White breed, the CI breeding index and the Tyler index is 80%. Therefore, the above testifies to the effectiveness of using these indices in selection and breeding work. It was established that the maximum increase in additional production was obtained from young pigs of the genealogical line Tafftus C61203 UA 8819345 (+2.52%), I experimental group according to the Tyler index (+3.98%) and the CI selection index (+4.30%).

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Продуктивні якості молодняку свиней великої білої породи різних генеалогічних ліній та внутрішньопородної диференціації за деякими інтегрованими показниками

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Мета роботи — дослідити відгодівельні та м'ясні якості молодняку свиней великої білої породи різних генеалогічних ліній та внутрішньопородної диференціації за деякими інтегрованими показниками, а також розрахувати економічну ефективність результатів експерименту. Оцінку молодняку свиней за відгодівельними та м'ясними якостями проводили з урахуванням таких кількісних ознак: середньодобовий приріст живої маси за період контрольної відгодівлі, г; вік досягнення живої маси 100 кг (діб); товщина шпигу на рівні 6–7 грудних хребців (мм); довжина охолодженої туші (см); довжина беконної половини охолодженої півтуші (см). Комплексну оцінку тварин піддослідних груп проводили за індексами Тайлера і Вангена. Біометричну обробку результатів досліджень проводили за методиками В. П. Коваленка та ін. (2010). Дослідження проведено в агроформуваннях Дніпропетровської області, м'ясокомбінаті «Джаз» та лабораторії тваринництва Інституту зернових культур НААН України. Установлено, що за відгодівельними і м'ясними якостями молодняку свиней генеалогічних ліній Taffus C61203 UA 8819345 і Azuro UA 8800557 великої білої породи відповідають класу еліта. Молодняк свиней генеалогічної лінії Taffus C61203 UA 8819345 переважає ровесників лінії Azuro UA 8800557 за віком досягнення живої маси 100 кг на 3,25%, товщиною шпигу на рівні 6–7 грудних хребців — на 5,74%, довжиною охолодженої туші — на 0,93%. Більша довжина охолодженої туші та довжина беконної половини охолодженої туші характерні для тварин лінії Azuro UA 8800557. Кількість вірогідних кореляційних зв'язків між відгодівельними і м'ясними якостями молодняку свиней великої білої породи, селекційним індексом СІ та індексом Тайлера становить 80%. Установлено, що максимальну прибавку додаткової продукції одержано від молодняку свиней генеалогічної лінії Taffus C61203 UA 8819345 (+2,52%), і піддослідної групи за індексом Тайлера (+3,98%) та селекційним індексом СІ (+4,30%). Критерієм відбору високопродуктивних тварин за селекційним індексом СІ є показники 57,69–78,57 бала, за індексом Тайлера — 214,89–242,85 бала. Економічна ефективність використання молодняку свиней зазначених груп забезпечує одержання додаткової продукції на рівні +3,98–4,30%.

Ключові слова: молодняк свиней, порода, відгодівельні і м'ясні якості, індекс, кореляція, економічна ефективність